## Supplemental Material.

## Table S1. Histologic features of hepatocyte apoptosis

- 1. Affected hepatocytes may have condensed hypereosinophilic cytoplasm and a somewhat angular outline.
- 2. Not associated with an inflammatory response unless there is simultaneous necrosis.
- 3. May occur spontaneously with one or two affected hepatocytes present in an occasional hepatic lobule.
- 4. In standard H&E-stained sections, apoptotic hepatocytes (apoptotic bodies) are usually rounded with condensed cytoplasm.
- 5. Rounded apoptotic bodies are typically surrounded by a clear halo.
- 6. Fragments of nuclear material may be present within affected cells.
- 7. Apoptotic bodies are frequently phagocytosized by adjacent normal cells including hepatocytes and macrophages.

## Table S2. Histologic Features of hepatocyte necrosis

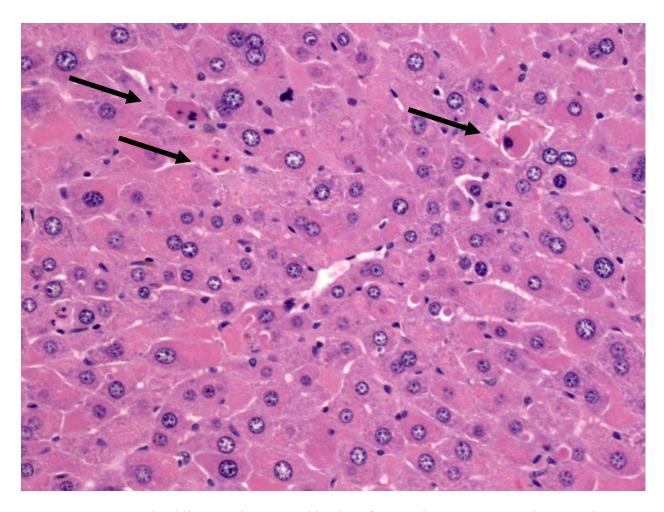
- 1. Early necrotic hepatocytes are swollen.
- 2. Cytoplasm has increased eosinophilia.
- 3. Nucleus undergoing lysis, not pyknosis.
- 4. May have a minimal associated inflammatory reaction.
- 5. Can be accompanied by glycogen depletion, hydropic degeneration, fatty change, hemorrhage, and "ballooning" of hepatocytes.

Table S3. Reevaluation of Single Cell Necrosis in Livers of Male Mice Exposed to GenX

Slide	Group	Necrosis	Apoptosis	Mitosis
7714	1	0	0	0
7717	1	0	0	0
7718	1	0	0	0
7722	1	1 (1 focus necrosis- neutrophils)	0	0
7723	1	0	0	0
7732	1	0	0	0
7734	1	0	0	0
7742	1	0	0	0
7750	1	1	0	0
7752	1	0	0	0
7758	1	0	0	0
7763	1	0	0	0
7765	1	0	0	0
7769	1	0	1	0
7772	1	0	0	0
7775	1	0	0	0
7788	1	0	0	0
7792	1	0	0	0
7798	1	0	0	0
7800	1	0	0	0
7803	1	0	0	0
7810	1	0	1	0
7813	1	0	0	0
7823	1	0	0	0
7825	1	0	0	0
7710	2	0	0	0
7728	2	0	0	0
7731	2	0	0	0
7737	2	0	0	0
7743	2	0	1	0
7748	2	0	0	0
7749	2	0	0	0
7754	2	0	0	0
7768	2	0	0	0
7776	2	0	0	0
7777	2	0	0	0
7779	2	0	0	0
7783	2	0	0	0
7784	2	0	0	0
7786	2	0	0	0
7787	2	0	0	0
7794	2	0	0	0

7797					
7807 2 0 0 0 0 0 7808 2 0 0 0 0 0 7809 2 0 0 0 0 0 0 0 7811 2 0 0 0 0 0 0 0 7811 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	7797	2	0	0	0
7808         2         0         0         0           7809         2         0         0         0           7811         2         0         0         0           7817         2         0         0         0           7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7729         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7744         3         0         0         0           7745         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3	7805	2	0	0	0
7809         2         0         0         0           7811         2         0         0         0           7817         2         0         0         0           7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7729         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7745         3         0         0         0           7756         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7774         3         0         0         0           77789         3	7807	2	0	0	0
7811         2         0         0         0           7817         2         0         0         0           7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7721         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7745         3         0         0         0           7746         3         0         0         0           7756         3         0         0         0           7761         3         0         0         0           7762         3         0         0         0           7763         3         0         0         0           7794         3         0         0         0           7799         3         0         0         0           7799         3	7808	2	0	0	0
7817         2         0         0         0           7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7729         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7745         3         0         0         0           7746         3         0         0         0           7756         3         0         0         0           7761         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7779         3         0         0         0           7799         3         0         0         0           7802         3	7809	2	0	0	0
7817         2         0         0         0           7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7729         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7745         3         0         0         0           7746         3         0         0         0           7756         3         0         0         0           7761         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7779         3         0         0         0           7799         3         0         0         0           7802         3	7811	2	0	0	0
7826         2         0         0         0           7711         3         0         0         0           7720         3         0         0         0           7721         3         0         0         0           7729         3         0         0         0           7740         3         0         0         0           7741         3         0         0         0           7745         3         0         0         0           7746         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7762         3         0         0         0           7763         3         0         0         0           7764         3         0         0         0           7767         3         0         0         0           7789         3         0         0         0           7793         3         0         0         0           7802         3		2	0	0	0
7711 3 0 0 0 0 0 7720 3 0 0 0 0 7721 3 0 0 0 0 0 0 7721 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		2	0	0	0
7720 3 0 0 0 0 0 7721 3 0 0 0 0 0 77221 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					
7721 3 0 0 0 0 0 7729 3 0 0 0 0 0 7740 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			<u> </u>		
7729 3 0 0 0 0 0 7740 3 0 0 0 0 0 7741 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			0	0	
7740 3 0 0 0 0 0 7741 3 0 0 0 0 0 7741 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			<u> </u>		
7741         3         0         0         0           7745         3         0         0         0           7746         3         0         0         0           7756         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7799         3         0         0         0           7814         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7827         3         0         0         0           7828         3         0         0         0           7828 </td <td></td> <td></td> <td></td> <td></td> <td></td>					
7745         3         0         0         0           7746         3         0         0         0           7756         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosisneutrophils)         0         0           7827         3         0         0         0           7828         3         0         0         0           7712 <td></td> <td></td> <td></td> <td></td> <td></td>					
7746         3         0         0         0           7756         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7762         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7827         3         0         0         0           7828         3         0         0         0           7828 </td <td></td> <td></td> <td><u> </u></td> <td></td> <td></td>			<u> </u>		
7756         3         0         0         0           7760         3         0         0         0           7761         3         0         0         0           7762         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7822         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7715 </td <td></td> <td></td> <td><u> </u></td> <td></td> <td></td>			<u> </u>		
7760         3         0         0         0           7761         3         0         0         0           7762         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7822         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7715         4         0         2         0           7716 </td <td></td> <td></td> <td></td> <td></td> <td></td>					
7761         3         0         0         0           7762         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7821         3         0         0         0           7822         3         0         0         0           7823         3         0         0         0           7824         3         0         0         0           7827         3         0         0         0           7709         4         0         1         0           7715 </td <td></td> <td></td> <td></td> <td></td> <td></td>					
7762         3         0         0         0           7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7796         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1(Focal necrosis-neutrophils)         0         0           7821         3         0         0         0           7822         3         0         0         0           7827         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7715         4         0         2         1           7716 </td <td></td> <td></td> <td><u> </u></td> <td></td> <td></td>			<u> </u>		
7767         3         0         0         0           7774         3         0         0         0           7789         3         0         0         0           7790         3         0         0         0           7793         3         0         0         0           7796         3         0         0         0           7799         3         0         0         0           7802         3         0         0         0           7814         3         0         0         0           7820         3         1 (Focal necrosis-neutrophils)         0         0           7827         3         0         0         0           7828         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7712         4         0         2         1           7716         4         0         2         0           7724         4         0         1         0					
7774       3       0       0       0         7789       3       0       0       0         7790       3       0       0       0         7793       3       0       0       0         7796       3       0       0       0         7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       0       2       1         7716       4       0       2       0         7724       4       0       1       0			<u> </u>		
7789       3       0       0       0         7790       3       0       0       0         7793       3       0       0       0         7796       3       0       0       0         7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       with neutrophils)       0       0         7715       4       0       2       1         7716       4       0       1       0         7724       4       0       1       0			<u> </u>		
7790       3       0       0       0         7793       3       0       0       0         7796       3       0       0       0         7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       0       2       1         7715       4       0       2       1         7716       4       0       1       0         7724       4       0       1       0					
7793       3       0       0       0         7796       3       0       0       0         7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       vith neutrophils)       0       0         7715       4       0       2       1         7716       4       0       1       0         7724       4       0       1       0					
7796       3       0       0       0         7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1( Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       vith neutrophils)       0       0         7715       4       0       2       1         7716       4       0       1       0         7724       4       0       1       0					
7799       3       0       0       0         7802       3       0       0       0         7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       with neutrophils)       0       0         7715       4       0       2       1         7716       4       0       1       0         7724       4       0       1       0					
7802     3     0     0     0       7814     3     0     0     0       7820     3     1( Focal necrosis-neutrophils)     0     0       7822     3     0     0     0       7827     3     0     0     0       7828     3     0     0     0       7709     4     0     1     0       7712     4     0     0     0       7715     4     0     2     1       7716     4     0     1     0       7724     4     0     1     0					
7814       3       0       0       0         7820       3       1(Focal necrosis-neutrophils)       0       0         7822       3       0       0       0         7827       3       0       0       0         7828       3       0       0       0         7709       4       0       1       0         7712       4       ineutrophils       0       0         7712       4       0       2       1         7715       4       0       2       0         7716       4       0       1       0         7724       4       0       1       0			<u> </u>		
7820         3         1( Focal necrosis-neutrophils)         0         0           7822         3         0         0         0           7827         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7712         4         3 foci necrosis with neutrophils         0         0           7715         4         0         2         1           7716         4         0         1         0           7724         4         0         1         0					
7820         3         neutrophils)         0         0           7822         3         0         0         0           7827         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7712         4         1 (3 foci necrosis with neutrophils)         0         0           7715         4         0         2         1           7716         4         0         1         0           7724         4         0         1         0	/814	3		U	U
7827         3         0         0         0           7828         3         0         0         0           7709         4         0         1         0           7712         4         1 (3 foci necrosis with neutrophils)         0         0           7715         4         0         2         1           7716         4         0         1         0           7724         4         0         1         0			neutrophils)		
7828       3       0       0       0         7709       4       0       1       0         7712       4       1 (3 foci necrosis with neutrophils)       0       0         7715       4       0       2       1         7716       4       0       2       0         7724       4       0       1       0			0	0	
7709       4       0       1       0         7712       4       1 (3 foci necrosis with neutrophils)       0       0         7715       4       0       2       1         7716       4       0       2       0         7724       4       0       1       0					
7709 4 0  1 (3 foci necrosis vith neutrophils)  7712 4 0 2 1  7716 4 0 2 0  7724 4 0 1 0	7828	3	0		
7712 4 with neutrophils)  7715 4 0 2 1  7716 4 0 2 0  7724 4 0 1 0	7709	4	0	1	0
7715 4 0 2 0 7716 4 0 1 0	7712	4		0	0
7716 4 0 1 0	7715	4	0	2	1
7/24 4 0	7716	4	0	2	0
7726 4 0 2 0	7724	4	0	1	0
	7726	4	0	2	0

7730	4	0	2	1
7735	4	0	2	1
7736	4	0	2	1
7738	4	0	1	1
7739	4	0	1	0
7744	4	0	2	1
7747	4	0	1	1
7751	4	0	1	1
7759	4	0	2	1
7764	4	0	1	0
7770	4	0	2	0
7778	4	0	1	2
7780	4	0	2	1
7781	4	0	2	1
7782	4	0	1	0
7785	4	0	1	1
7801	4	0	1	1
7804	4	0	2	1
7815	4	0	0	0
7804	4	0	2	1



**Figure S1.** H&E stained liver section (20× objective) from male mouse exposed to 5 mg/kg GenX exhibiting multiple apoptotic hepatocytes (arrows).